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Canada Communicable Disease Report CCDR

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International Notes

MEASLES

Progress toward global control and regional elimination, 1990-1998

In 1989, the World Health Assembly adopted a goal of reducing measles morbidity and mortality by 90% and 95%, respectively, by 1995, compared with estimates of the disease burden in the prevaccine era. In 1990, the World Summit for Children adopted a goal of vaccinating 90% of children against measles by the year 2000. Regional measles elimination goals have been established in the Americas (by the year 2000), Europe (by the year 2007) and the Eastern Mediterranean (by the year 2010). This article updates progress toward global measles control and regional elimination. It includes information for 1997 on measles vaccination coverage and incidence reported to the World Health Organization (WHO), and WHO estimates of global measles morbidity and mortality in 1997 compared with the prevaccine era.

Morbidity and routine vaccination coverage

There were 702,298 reported cases in 1997, a decline of 48% compared to 1990. Among the six WHO regions, Africa reported the highest measles incidence in 1997 (47.5 per 100,000), while the Americas reported the lowest of any region (6.5 per 100,000). However, the 51,915 cases of measles reported from the Americas in 1997 represent a 25-fold increase over the record low number of 2,109 cases in 1996. The increase was due to a large measles outbreak in the State of São Paulo, Brazil, that spread to other states in Brazil and to other countries in the region.

Since 1990, global routine vaccination coverage among children aged 1 year with one dose of measles vaccine has levelled off at approximately 80% (Figure 1). In 1997, reported global coverage was 82% and vaccination coverage was > 90% in two WHO regions, the Americas (93%) and the Western Pacific (93%). The lowest vaccination coverage (57%) in 1997 was reported from Africa, where two (4%) of 48 countries reported vaccination coverage > 90%, and 10 countries (21%) reported routine coverage < 50%. Approximately 346 million children, 57% of the world's children aged < 5 years, live in the countries which either reported a routine measles vaccination coverage < 90% or did not provide a report in 1997. More than two-thirds of these children live in Africa and South-East Asia (Table 1).

Estimated morbidity and mortality

Each year WHO estimates actual global measles morbidity and mortality for the following reasons: 1) measles deaths are not routinely reported to WHO; 2) measles is not a notifiable disease in some countries; and 3) underreporting of measles cases occurs in most regions. These estimates are based on the number of surviving infants, reported vaccination coverage data (routine and mass campaigns), and average vaccine effectiveness and case-fatality rates

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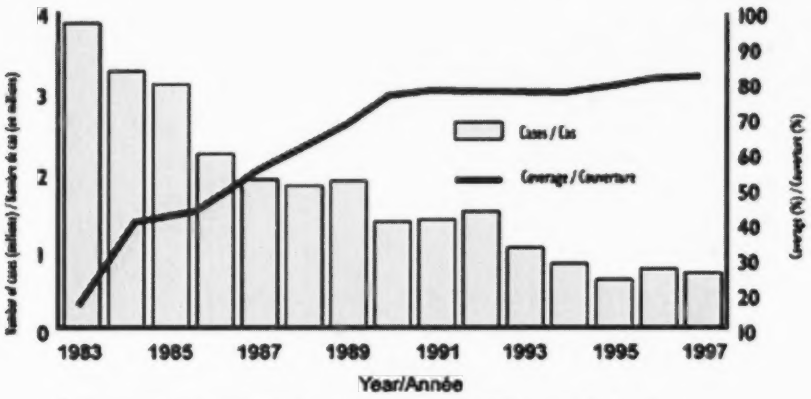
based on published literature. For 1997, WHO estimated that almost 31 million cases and 960,479 deaths occurred worldwide (Table 2). By end-1997, global measles morbidity and mortality were reduced by 74% and 85%, respectively, compared with the prevaccine era. The 1995 morbidity and mortality reduction goals of the World Health Assembly were reached in the Americas and the Western Pacific. Europe has reached the mortality reduction goal. Of the estimated global number of measles deaths in 1997, 99% occurred in the least developed and developing countries, and < 1% in developed countries or countries in economic transition.

Figure 1 Measles cases and vaccination coverage worldwide, 1986-1997[+]



[+] As reported to WHO in Geneva as of 20 July 1998 / Tel que communiqués à l'OMS à Genève le 20 juillet 1998

Supplementary vaccination campaigns

In the Americas, the Pan American Sanitary Conference resolved in 1994 to eliminate indigenous transmission of measles from the western hemisphere by the year 2000 using a strategy that includes three vaccination components (catch-up, keep-up, and follow-up)[*] and enhanced surveillance with laboratory investigation of suspected cases. Catch-up vaccination campaigns were first implemented in Cuba in 1987. By end-1996, all countries in the Americas, except the United States, had conducted similar campaigns. Most countries of the region have also completed follow-up campaigns (Figure 2).

Outside the Americas, catch-up campaigns have been increasingly used to supplement routine vaccination in countries aiming at outbreak prevention or measles elimination. Countries in Europe (e.g. the United Kingdom), the Western Pacific (Mongolia, New Zealand, and the Pacific island nations), southern Africa, the Eastern Mediterranean (Bahrein, Jordan, Kuwait, Oman), and South-East Asia (Bhutan, Maldives) have completed catch-up campaigns. In 1997 alone, 32.8 million children were vaccinated as part of catch-up or follow-up campaigns. As of November 1998, catch-up campaigns were ongoing in Australia, the Philippines, Romania, the Syrian Arab Republic, and Tunisia.

Supplementary measles vaccination campaigns in high-risk areas, such as densely populated cities in developing countries, are being increasingly used to accelerate measles control and reduce measles mortality. In 1997, immunization campaigns were implemented in high-risk areas for measles in

10 countries (five in Africa, four in South-East Asia and one in the Western Pacific). These campaigns reached a total of > 5.8 million children.

Table 1 Measles, progress toward reduction and vaccination coverage goals, by WHO region,1990 and 1997

Table 2 Measles cases and deaths in prevaccine era and in 1997, by WHO region[a] Region Annual cases, prevaccine era Cases, 1997 Cases prevented[b] (%) Annual deaths, prevaccine era Deaths, 1997 Deaths prevented[b] (%) Africa 14,477,000 11,439,541 48 1,309,000 549,125 73 Americas[c] 13,277,000 53,661 99 695,000 61 > 99 Eastern Mediterranean 10,536,000 4,444,713 70 767,000 111,114 90 Europe 12,085,000 1,923,217 81 151,000 6,509 95 South-East Asia 30,597,000 9,586,577 70 2,142,000 268,482 88 Western Pacific 25,485,000 3,531,880 90[d] 720,000 25,188 97 **Total 106,457,000 30,979,589 74 5,784,000 960,479 85**

[a] WHO estimates. [b] Adjusted for population growth. [c] Reported number of measles cases and deaths as of 8 December 1998. PAHO estimates that the completeness of reporting for measles cases and deaths is approximately 100%. [d] Based on estimates provided by the WHO Regional Office for the Western Pacific.

Figure 2 Nationwide measles immunization campaigns, January 1987 to November 1998*

* Data as of 30 October 1998.
The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

WHO Editorial Note: Substantial progress has been made toward achieving global measles morbidity and mortality reduction targets. The Region of the Americas has achieved both goals and demonstrates the feasibility of effective measles control regionwide and interruption of indigenous measles transmission in several countries. However, despite the widespread availability

of safe and effective measles vaccines since 1963, measles still results in nearly one million deaths annually, or approximately 10% of global mortality from all causes among children aged < 5 years. According to studies of the global burden of disease, measles was the eighth leading cause of death worldwide in 1990, representing 2.7% of disability-adjusted life years. Measles remains highly endemic in many countries in Africa, Asia, and Europe, irrespective of the level of economic development. However, the burden of measles-related deaths affects developing countries almost exclusively.

Routine measles vaccination coverage at the global level reached 80% in 1990, and has shown minimal further progress from 1990 through 1997. Routine coverage measured at the global level conceals large differences in levels attained by the six WHO regions, and among countries within regions. The Americas and Western Pacific have achieved the World Summit for Children coverage goals; however, both regions have countries that have routine vaccination coverage < 90%.

The three WHO regions that have embarked upon regional measles elimination continue to make progress toward achieving the goal. Implementation of the measles elimination strategies of the Pan American Health Organization (PAHO) resulted, in 1996, in the lowest measles incidence ever reported by a WHO region and in the virtual elimination of measles-related deaths in the Americas. Two workshops were held in the Eastern Mediterranean in 1998 to develop plans of action for accelerated measles control or elimination, and the Gulf countries (Bahrain, Kuwait, Qatar, Oman, Saudi Arabia, and United Arab Emirates) have established a target of measles elimination by the year 2000. In Europe, a strategic plan for implementation of the elimination strategies has been prepared and the European goal of measles elimination by the year 2007 was endorsed by the Regional Committee in September 1998. In addition, six southern African countries (Botswana, Malawi, Namibia, South Africa, Swaziland, and Zimbabwe) have adopted national measles elimination goals.

Effective measles surveillance is critical to monitoring the impact of vaccination activities, and adapting policies and strategies as needed. Further strengthening of measles surveillance systems is required both in developing and developed countries. The importance of measles surveillance, which combines epidemiologic data and virologic surveillance, increases as the incidence of disease decreases to low levels following intensive outbreak prevention and/or measles elimination measures. During 1997 and 1998, three workshops on laboratory diagnosis of measles and on techniques for measles virus isolation were conducted, two in the Eastern Mediterranean and one in Africa. Standardized nomenclature for describing the genetic characteristics and relationships among eight groups of wild-type measles viruses has been developed in 1998.

Further progress toward achieving the global measles reduction and vaccination coverage goals by the year 2000 primarily depends on future performance of vaccination programmes. Three vaccination-related priority areas need to be addressed immediately to accelerate measles control and achieve regional elimination. Firstly, additional efforts are needed to improve global routine vaccination coverage among infants and young children, and to develop the infrastructure necessary to achieve this. Secondly, supplementary mass vaccination campaigns designed to reach children not covered by routine services are needed in low-income countries to reduce measles-related mortality. Any supplemental vaccination campaign in high-risk areas should reach all children in the target age range regardless of measles vaccination status or history of previous measles disease. Thirdly, in countries with measles elimination goals, the highest coverage possible (> 90%) in catch-up and follow-up campaigns is needed to achieve and maintain elimination.

The phased implementation of measles control/elimination activities must facilitate and not jeopardize the current global polio eradication initiative which is now at an advanced stage. Measles control activities in polio-endemic countries, or countries with focal poliovirus transmission, should aim at morbidity and mortality reduction. Measles elimination should be considered only in polio-free countries. The goal of measles elimination in the western hemisphere by the year 2000 can be achieved if vaccination and surveillance activities are rapidly intensified in the remaining countries with continuing transmission. In July 1996, a meeting cosponsored by WHO, PAHO, and the United States Centers for Disease Control and Prevention concluded that global measles eradication was technically feasible with available vaccines. The prospects for a global effort to eradicate measles early in the 21st century are contingent on successful completion of global polio eradication and regional elimination in the western hemisphere.

Source: *WHO Weekly Epidemiological Record, Vol 73, No 50, 1998.*

* Catch-up is defined as conducting a one-time, nationwide vaccination campaign targeting usually all children aged 9 months to 14 years regardless of history of measles disease or vaccination status; keep-up is defined as routine services aimed at vaccinating > 90% of each successive birth cohort, and follow-up is defined as subsequent nationwide vaccination campaigns conducted every 2 to 5 years targeting usually all children born since the catch-up campaign.

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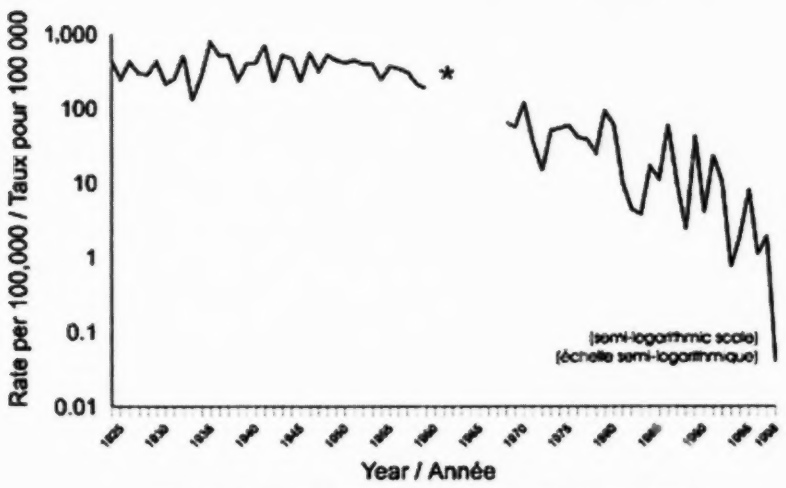
UPDATE ON THE ELIMINATION OF MEASLES IN CANADA, 1998

Introduction

Measles is a moderately severe febrile viral disease frequently complicated by pneumonia and ear infections. Acute and long-term brain involvement, and death occur at rates of 1 to 2 per 1,000 cases, respectively. Since national reporting for measles began in Canada in 1924, the annual incidence has ranged from 0.04 to 767 cases per 100,000 population (Figure 1).

In 1992, the participants at the Canadian National Conference on Measles Control proposed a goal to eliminate indigenous measles in Canada by the year 2005; this goal was adopted by the Conference of Deputy Ministers in December 1995. In 1994, at the governing council of the Pan American Health Organization, Canada committed to the goal of measles elimination by the year 2000. The need to increase coverage rates and to adopt a two-dose measles schedule was pivotal to the elimination goal. The National Advisory Committee on Immunization also recommended implementing school catch-up campaigns in all provinces and territories.

Figure 1 Annual incidence of measles in Canada, 1924-1998



* No national reporting 1959-1968 / Pas de données de 1959-1968

Table 1 Confirmed measles cases

	1998	1997
ND/T.-N.	0	9
PE/Î.-P.-É.	0	0
NS/N.-É.	0	2
NB/N.-B.	0	4
QU/Qc	2	4
ON/Ont.	6	22
MB/Man.	0	0
SK/Sask.	1	20
AB/Alb.	1	245
BC/C.-B.	1	275
YT/Yn	0	0
NT/T.N.-O.	0	0
Visitor/Visiteur	1	0
TOTAL	**12**	**581**

Epidemiology

In 1998, Canada recorded the lowest number of confirmed measles cases ever reported nationally. A confirmed case of measles is defined in one of the following two ways:

1) laboratory-confirmed infection in the absence of recent (1 to 14 days) immunization with measles-containing vaccine. (Laboratory confirmation is a positive serologic test for measles specific IgM antibody; or, a significant rise in measles specific antibody titre between acute and convalescent sera; or, isolation of measles virus from an appropriate clinical specimen.)

or

2) clinical measles in a person who is epidemiologically linked to a laboratory-confirmed case. (A clinical case is characterized by all of the following features: fever > 38.3^{o} C; cough, coryza, or conjunctivitis; and generalized maculopapular rash for a least 3 days.)

A total of 12 confirmed measles cases were reported through the Enhanced Measles Surveillance System in 1998. This is an active surveillance system whereby provinces and territories report cases (and no cases) via e-mail to Health Canada on a weekly basis. All of the reported cases were laboratory confirmed. Only one specimen for measles virus isolation was submitted to a public-health laboratory. (For instructions on how to obtain appropriate specimens, see *Measles Surveillance: Guidelines for Laboratory Support,* ***Canada Communicable Disease Report***, 1998;24:33-44). Five additional reports were received on cases exhibiting clinical symptoms, but these had inconclusive or no confirmatory laboratory work to support the diagnosis. It is documented in three of these five "clinical" cases that the caregiver refused and/or the clinician was unable or unwilling to collect a serum sample. No specimens for measles virus isolation were collected.

The confirmed cases were distributed across the country and, unlike the majority of cases in 1997, none in 1998 were related to outbreaks (Table 1). Five of the confirmed cases had traveled outside Canada 7 to 21 days prior to onset of rash. Only one case had identified contact with another measles case and that was in an individual who was exposed outside Canada.

For the confirmed cases, the median age at onset of rash was 5 years (range < 1 to 33 years). There were seven females and five males infected; only two cases were known to require hospitalization. Vaccine histories were available for nine of the 12 confirmed cases. Seven cases had received their first vaccine and two had not. Of the two unvaccinated, one was not vaccinated due to an egg allergy (as indicated in the fifth edition of the ***Canadian Immunization Guide***, egg allergy is no longer considered a contraindication to immunization with measles, mumps, and rubella vaccine [MMR]) and one "missed" their appointment for immunization. For those vaccinated, two received the vaccine before their first birthdays while living outside Canada. Only one of the nine cases was documented as receiving a second dose of MMR.

Since 1997, every province and territory has had two doses of measles in their routine immunization schedule. To date, all but three provinces and territories have implemented and completed school "catch-up" campaigns. The 1998 national coverage survey estimates the percent coverage by the second birthday at 93.3% for the 1995-1996 birth cohort receiving their measles vaccine on or after the first birthday (96% for those receiving the first dose at any time). Table 2 summarizes recent estimates for percent coverage for 7-year-olds (unpublished data, Division of Immunization, Health Canada).

Table 2 Percent coverage for measles by the seventh birthday, in the 1995-1996 birth cohort (CI ± 1% to 5%)*

	One dose	Two doses
First dose anytime	98.8	55.9
First dose ≥ 1 yr of age	97.6	50.2

* The following explanations have been proposed as to why the numbers may be so low in this cohort:

1) on average, catch-up reached only 90% of children where implemented

2) catch-up programs have not been implemented in three provinces (representing about 7% of the population)

3) limited catch-up of preschoolers in some provinces

4) poor recording of catch-up doses in regular immunization records during school-based programs in some provinces

5) lack of immunization monitoring and updating at school entry.

Discussion

In 1998, Canada recorded the lowest annual total for measles cases in over 70 years of national reporting. However, as the country continues to move toward the goal to eliminate indigenous measles, it is important to sustain and even improve current immunization coverage for all susceptible populations.

As well, clinicians must be urged to maintain a high index of suspicion for measles, to report all suspect cases rapidly, and to try to confirm all suspect cases. Most cases meeting the clinical case definition will **not** be measles because of the non-specificity of the clinical definition; therefore, only cases with laboratory confirmation or epidemiologic links to a confirmed case can be considered a case. Serologic specimens as well as nasophargeal/throat swabs or urine specimens for virus isolation should be collected from all suspect measles cases.

Acknowledgments

The Working Group on Measles Elimination in Canada and the Division of Immunization would like to thank all of those who reported weekly to the Enhanced Measles Surveillance System in 1998.

Source:

M Litt, BScN, RN, MHSc, Division of Immunization, Laboratory Centre for Disease Control, Ottawa ON; J Waters, MD, Chair, Working Group on Measles Elimination in Canada.

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LABORATORY ASPECTS OF THE MEASLES ELIMINATION PROGRAM IN CANADA

The laboratory has an important role in the surveillance of measles as part of the measles elimination program in Canada. Its role is to provide serologic confirmation of measles cases and to genetically characterize (genotype) measles virus isolates for molecular epidemiologic purposes[1,2].

Measles virus can be isolated from a urine specimen, a nasopharyngeal swab, or a throat swab[1]. Isolation is important for several reasons: 1) measles virus genotyping allows the interruption of transmission of indigenously circulating measles virus strains to be documented, as the United States Centers for Disease Control and Prevention has done; 2) genotyping provides confirmation of traditional epidemiologic data showing measles virus transmission routes; 3) genotyping allows the differentiation of wild-type from vaccine strain measles virus in cases where vaccine may be implicated in serious illness; and 4) measles virus isolation can provide another method for measles confirmation, albeit rather insensitive but extremely specific - the occasional suspected measles case showing inconclusive serology is an example where virus isolation is useful diagnostically[3,4].

Measles virus isolates from 18 sporadic or outbreak measles cases from 1996 to 1998 have been genetically characterized. Table 1 shows representative Canadian measles virus isolates and the genotypic designations. The 18 isolates characterized belong to genotypes C2, D5, or D6. Genotypes C2 and D6 are strains found circulating in Europe, and genotype D5 has been found in Thailand and is currently the predominant genotype found in Japan[3,5]. A brief description of several of these measles isolates follows.

In February and March 1997, four measles virus isolates from the large outbreak in British Columbia were determined to be measles virus genotype D6 [6]. The epidemiologic spread of measles from the outbreak in British Columbia to Alberta was confirmed as seven Alberta isolates, from February and March 1997, were also determined to be genotype D6[7].

Interestingly, two isolates from Calgary in June 1997 were determined to be genotype C2. This supported the epidemiologic data showing this to be a second distinct Alberta measles outbreak with the index case having a travel history to Germany (Calgary Regional Health Authority, Calgary: personal communication, 1998).

A July 1997 isolate from a Montreal measles case, having a recent travel history to France, was determined to be genotype C2 supporting the probable importation of measles from Europe (Dr. P.A. Pilon, *Unité des Maladies infectieuses de Montréal-Centre*, Montreal: personal communication, 1999).

In conclusion, the ultimate identification of measles cases must take into account both clinical symptoms and laboratory results. The timely collection of

clinical specimens for serology and virus isolation by public-health professionals and clinicians for the laboratory confirmation of measles cases are key components of the measles elimination program in Canada[8].

Table 1 Representative Canadian measles virus isolates, 1996 to 1998

Date of Measles Virus Isolation	Location	Genotype*	Comments
May 1996	Toronto ON	C2	
February 1997	Vancouver BC	D6	outbreak case
February 1997	Calgary AB	D6	outbreak case epidemiologically linked to British Columbia outbreak
February 1997	Edmonton AB	D6	outbreak case epidemiologically linked to British Columbia outbreak
March 1997	St. John's NF	D6	outbreak case
June 1997	Calgary AB	C2	outbreak case epidemiologically linked with case having recent travel history to Germany
July 1997	Montreal QC	C2	case having recent travel history to France
May 1998	Montreal QC	D5	sporadic case

* Genetic characterization is based on the sequencing of 450 nucleotides of the carboxyl-terminal of the nucleoprotein gene and comparison of this nucleotide sequence with reference strain sequences representing 15 known measles virus genotypes.

Acknowledgments

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Source: *G Tipples, PhD, Viral Exanthemata, Bureau of Microbiology, LCDC, Winnipeg MB.*

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International Notes

DESTRUCTION OF THE SMALLPOX VIRUS

The World Health Organization's (WHO) ad hoc Committee on orthopox virus infections, meeting in Geneva on 14 and 15 January 1999, voted in favour of the destruction of the last stocks of smallpox virus still kept in the WHO collaborating centres for smallpox and other poxvirus infections in the Russian Federation and the United States. Seven of the nine Committee members voted for destruction, five in favour of immediate destruction and two in favour of eventual destruction following a review in 5 years. Two Committee members supported indefinite retention of the stocks.

Since the global eradicaton of smallpox was confirmed in 1980, the Committtee has met a number of times to oversee post eradication policies and programs. From 1986 onwards, it foresaw the possible destruction of smallpox virus stocks and recommended a program of work involving preservation of the basic genetic information of the virus, wide consultation with the scientific community, and the development of specific procedures to be followed when the virus is destroyed.

In 1990, after the World Health Assembly adopted a resolution recommending destruction of smallpox viruses, WHO recommended the destruction by 31 December 1993 of existing stocks in the two WHO collaborating centres which were depositaries of these viruses, located in the Russian Federation and the United States. Destruction was postponed at the end of 1993, to allow further studies of the variola virus genome. The WHO ad hoc Committee, convened in September 1994, proposed destruction by 30 June 1995. The World Health Assembly decided in 1996 that destruction should take place by 30 June 1999. It was envisioned that the period between the date initally chosen (31 December 1993) and June 1999 would be used to achieve a broader consensus on the issue.

Prior to the meeting of the Committee, and in order to determine if a broader consensus had been reached on the issue of the destruction of the smallpox virus stocks, WHO undertook an inventory of the positions of its 191 Member States on the proposed destruction in accordance with the 1996 resolution. The survey showed that among the 79 countries which responded, situated in all WHO regions, a large majority (94%) was in favour of its complete implementation.

The members of the Committee recommended that if the World Health Assembly decides to delay the destruction, WHO should ensure regular inspections of the two repositories of the smallpox virus. They also agreed that WHO should advise its Member States to retain their existing stocks of smallpox vaccine, and that the deliberate release of smallpox virus into the environment should be considered a crime against humanity. The Committee also recommended that WHO Member States should be asked to confirm that they do not have stocks of smallpox virus.

Source: *WHO Weekly Epidemiological Record, Vol 74, No 4, 1999.*

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